

# The CEDRA Corporation's COMMAND OF THE MONTH

A monthly information bulletin

April 2013

FEATURED COMMAND  
Points to HEC-RAS  
Cross-Sections



## Application Description

Those of you involved with civil engineers have probably heard of HEC-RAS, which stands for Hydrologic Engineering Centers River Analysis System. This is a software package that provides the ability to analyze natural and constructed channels. Developed and maintained by the US Army Corps of Engineers, HEC-RAS is a very popular and useful software used by a large number of civil engineers nationally.

With GIS becoming more accepted by the engineering community the question of how can ArcGIS be used with HEC-RAS arises. As an example of this, we were recently asked by a civil engineering client of ours if there was a way to move ArcGIS data into HEC-RAS.

In developing a HEC-RAS model the foundation of the geometric network is a cross-section. As such, the perfect application of utilizing ArcGIS would be the generation of the cross-section data that is used in a HEC-RAS model.

## The CEDRA Solution

To accommodate the application described above, the [Points to Hec-Ras Sections] command located within the CEDRA-AVland-CrossSection Toolbar, see Figure 1, was created.

## Points to Hec-Ras Overview

With the [Points to Hec-Ras Sections] menu command the user is able to create a RAS GIS Import File which can be imported into the Geometric Data Editor within the

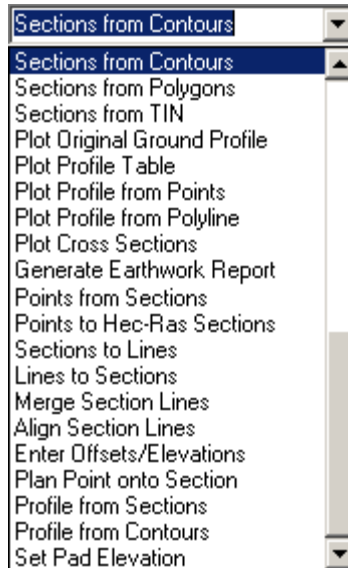


Figure 1  
CEDRA-AVland-CrossSection  
Toolbar

HEC-RAS software package. This file is created using point and line features which represent reaches and cross-sections along the reaches. Shown in Figure 2 is a single Stream (reach), which is a polyline comprised of 5 vertices, and two cross-sections along the stream, each of which are polylines.

### Command Of The Month bulletin

*This month's issue discusses how to create a RAS GIS Import File which can be imported into the HEC-RAS software package for modeling.*

The left-most cross-section has 4 points describing the surface of the cross-section, while the right-most cross-section

has 6 points which describe the cross-section surface. In preparing the RAS GIS Import File the command projects the *Cross-Section Points* upon the *Cross-Section* lines and first, determines which *Cross-Section* line the *Cross-Section Point* is associated with after which the command computes a plus value along the identified cross-section line.

The elevation value associated with the *Cross-Section Point*, along with the computed plus value, are required data for the RAS GIS Import File.

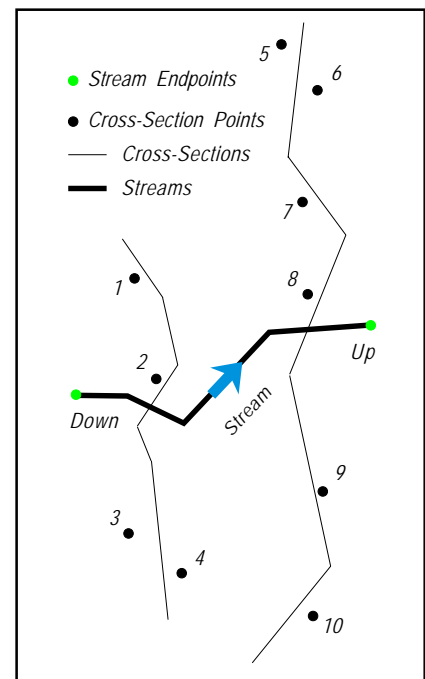
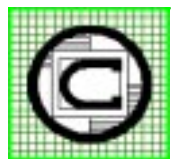


Figure 2  
Single Stream with  
2 Cross-Sections,  
in ArcMap the stream is drawn down-  
stream to upstream



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For this command to operate at least two layers must be present. One layer should contain the *Cross-Section Points* while the other contains the *Cross-Section Lines*. For full compatibility with the HEC-RAS software, two additional layers are required. One containing the *Stream End Points* and another containing the *Stream Lines*.

So that, to create a fully functional RAS GIS Import File four layers will be needed. The legend in the upper left corner of Figure 2 identifies the 4 layers.

The direction of the stream and cross-section lines are important. The reason for this is that HEC-RAS uses station information to locate the cross-sections along a reach. In order for the stationing to be properly computed by this command, the reach lines must be drawn in ArcMap from **downstream to upstream**. This will ensure that the stationing of the cross-sections is properly computed. The stationing is computed by intersecting the cross-section with the stream and computing the plus value along the stream from the downstream end point.


In addition to creating a RAS GIS Import File, this command will also create a dBase table containing the cross-section data. So that in the sample shown in Figure 2, the dBase table would contain data for two cross-sections.

The left-most cross-section in the figure would be comprised of 5 records, the first of which would contain the station value of the cross-section (which represents the plus distance along the stream from the downstream end point) followed by 4 records, one each for each of the 4 points projected onto the cross-section.

The second cross-section would be comprised of 7 records. The right-most cross-section has 6 points associated with the cross-section line plus the one record containing the station value which then totals 7 records.

### Points to Hec-Ras Operation

To use this menu command, the user should:

- 1 **Scroll** down in the **table of contents area**, and **select** the **layers** that contain the cross-section point and line feature(s) to be processed.
- 2 If all features within the active layer are to be processed, proceed to the next step, otherwise, **select** with the  *Select Features from Active Layers* tool the **point** and **line features** to be processed.
- 3 **Scroll** down in the {CEDRA-AVI and CrossSections} menu combo box, and **select** the [Points to Hec-Ras Sections] menu command, see Figure 1. If the prerequisite conditions are not met, a warning message such as that shown in Figures 3 through 5 will be displayed. At this point click the OK button and make the appropriate adjustments.
- 4 If the layers contain selected features, proceed to the next step, otherwise, **click** at the **Yes** or **No** button, see Figure 6, to indicate whether or not all features in the active layers are to be processed. If the No button is selected, the command is aborted.
- 5 The user will now be asked to specify the stream point and line layers, see Figure 7. Note that these layers should not be

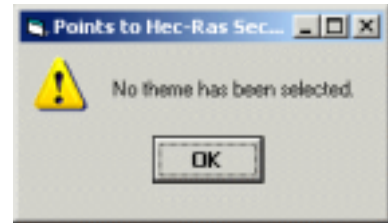


Figure 3  
No Layer Selected  
Warning Message



Figure 4  
Point and Line Layers must be selected Warning  
Message

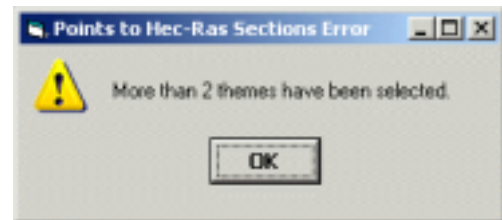


Figure 5  
More than 2 Layers selected Warning  
Message

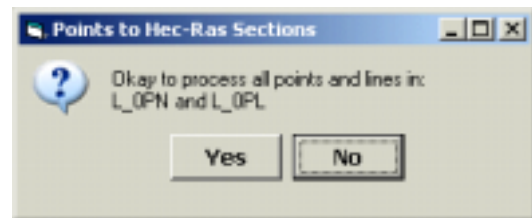


Figure 6  
Okay to Process All Features Query Message

selected in the Table of Contents when this command is invoked. As such:

**Scroll** down in the *Stream Point Layer*: data field, and **select** the point layer that contains the **stream end point features**. If there is no layer for this parameter, the <none> option can be selected.

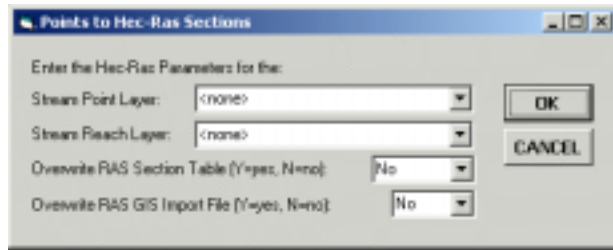


Figure 7  
Stream Point and Line Layer Specification Multi-Input  
Dialog Box

► 6 Scroll down in the *Stream Reach Layer:* data field, and **select** the line layer that contains the **stream line features**. If there is no layer for this parameter, the <none> option can be selected.

► 7 Scroll down in the *Overwrite RAS Section Table:* data field, and **select** the:

- **Yes** option to indicate that the dBase table created by this command is to be overwritten. Any data contained in this table will be deleted and as such lost.
- **No** option to indicate that the existing contents of the table are to be left as is. Any new data will be appended to the table.

► 8 Scroll down in the *Overwrite RAS GIS Import File:* data field, and **select** the:

- **Yes** option to indicate that the GIS Import File created by this command is to be overwritten. Any data contained in this file will be deleted and as such lost.
- **No** option to indicate that the existing contents of the file are to be left as is. Any new data will be appended to the file.

► 9 At this point the command begins to process the cross-section line features, one at a time.

► 10 **Enter** in the *Reach ID:* data field the **reach identification** that is associated with the cross-section. If a stream line feature has been identified as intersecting the cross-section

As a cross-section is processed, it is highlighted on the screen and a multi-input dialog box is displayed containing the various cross-section parameters. Prior to displaying the dialog box and if a stream line layer has been specified, the command will determine which stream line feature intersects the cross-section line feature being processed. This is done to extract default values for the dialog box. The dialog box that is displayed will be similar to that shown in Figure 8. As can be seen from the figure there are a number of parameters associated with a cross-section. As such:

**Enter** in the *Stream ID:* data field the **stream identification** that is associated with the cross-section. If a stream line feature has been identified as intersecting the cross-section line and if the stream line feature contains the field *STREAM\_ID*, the command will extract the value for this attribute and display it as the default. Otherwise a blank value will be displayed.



Figure 8  
Cross-Section Parameter Specification Multi-Input  
Dialog Box

► 11 **Enter** in the *Station:* data field the **station value** that is associated with the cross-section. If a stream line feature has been identified as intersecting the cross-section line the command will compute a station value for the user and display it as the default value. Otherwise 0.0 will appear as the default.

► 12 **Enter** in the *Maximum Offset for Point Projection:* data field the **maximum offset** that a point can have in order to constitute a valid projection on a cross-section line. Since it is possible for a cross-section point to be projected upon more than 1 cross-section line the user is able to specify a maximum offset value that is considered acceptable.

► 13 **Enter** in the *dBase Table:* data field the **full pathname of the dBase table to be created**, or select the File Browse button on the right side of this parameter to display the traditional Windows file navigation dialog box to specify the dBase table name.

- 14 Click at the **OK** button to begin the processing, or click at the **Cancel** button to abort the command.
- 15 At this point the command returns to Step 9 where the next cross-section line is processed. Shown in Figure 9 is an example of a multi-input dialog containing a different station value than what was shown in Figure 8 thereby indicating the next cross-section line that was processed. This continues until all cross-section lines are processed or the command is aborted.
- 16 Once all of the cross-sections have been processed, the command begins the process of storing the cross-section to the dBase table as well as creating the RAS GIS Import File.

Once the command has finished its processing a message in the status bar area will appear indicating how many cross-sections were processed, see Figure 10.

Shown in Figure 11 is the dBase table corresponding to the geometry shown in Figure 2. The first five records in the table pertain to the left-most cross-section in Figure 2 while the bottom 7 records pertain to the right-most cross-section. Those records which have an elevation value of 99999 indicate the start of a cross-section definition. The records below this record represent the cross-section points.

Shown in Figure 12 is the RAS GIS Import File corresponding to the geometry shown in Figure 2.

**Notes**

- a. In the HEC-RAS software reaches are drawn upstream to downstream. When the HEC-RAS file is created by this command the direction of the reach is reversed to adhere to the HEC-RAS convention.

- b. The *Overwrite RAS Section Table* and *Overwrite RAS GIS Import File* parameters can be used to erase existing information in the dBase table and RAS GIS Import File, respectively. If the command is executed a number of times and the user wishes to append data to the dBase table and RAS GIS Import File, these parameters should be set to the No option.

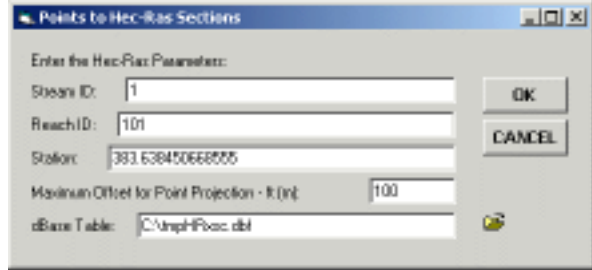


Figure 9  
Cross-Section Parameter Specification Multi-Input Dialog Box



Figure 10  
Completion of Cross-Section Processing Message

- c. If a Stream Line Layer is to be specified, the user should consider adding the STREAM\_ID and REACH\_ID fields to the layer. These fields are used to extract default values for a cross-section. Native ArcMap functionality or CEDRA functionality can be used to populate these fields with the appropriate values.

OID	STATION	ELEVATION
0	104.151287	99999
1	69.910177	400
2	135.071838	300
3	348.911355	200
4	523.173793	100
5	383.638451	99999
6	107.38743	1000
7	277.666861	900
8	562.793263	800
9	734.885004	700
10	893.656144	600
11	949.816013	500

Figure 11  
dBase Table containing Cross-Section Data

- d. The *Maximum Offset for Point Projection* parameter can be used to define the maximum valid offset of a point on a cross-section. In so doing the user is able to control which cross-section line the point will be projected upon, thereby enabling the user to process a large group of features at a time.
- e. The name of the dBase that appears in the Table of Contents will exclude the .dbf extension. For example, if the pathname c:\temp\table.dbf is specified, the table name that appears in the Table of Contents will be aTable. If a path is not specified, the command will store the table in the current working directory. The [SetWorking Directory] command can

be used to control the current working directory.

- f. In extracting the elevation value for a cross-section point feature, the command searches for the following fields; ELEVATION, Z, ELV, ELS, ELE, ELEV and CONTOUR, in the order shown. The first field found is used and the value assigned to the field is used as the default. If the cross-section point is a 3D point feature and its elevation value is not NULL then this elevation value is used.

```

BEGIN HEADER:
  UNITS: US CUSTOMARY
END HEADER:
BEGIN STREAM NETWORK:
  ENDPOINT: 4303.4092, 5254.0917, 300, 2
  ENDPOINT: 4712.7377, 5351.6338, 700, 3
  REACH:
    STREAM ID: 1
    REACH ID: 101
    FROM POINT: 2
    TO POINT: 3
    CENTERLINE:
      4303.4092, 5254.0917, 300
      4374.8239, 5252.3499, 400
      4449.7223, 5215.7716, 500
      4568.1663, 5342.9247, 600
      4712.7377, 5351.6338, 700
  END:
END STREAM NETWORK:
BEGIN CROSS-SECTIONS:
  CROSS-SECTION:
    STREAM ID: 1
    REACH ID: 101
    STATION: 104.151287225184
    NODE NAME:
    CUT LINE:
      4428.6521, 4936.0431
      4400, 5113.4216
      4386.979, 5212.495
      4445.441, 5298.952
      4420.783, 5389.3005
      4362.552, 5475.8601
    SURFACE LINE:
      4447.463, 5009.898, 400
      4373.822, 5064.009, 300
      4414.4878, 5277.56, 200
      4383.247, 5418.947, 100
  END:
  CROSS-SECTION:
    STREAM ID: 1
    REACH ID: 101
    STATION: 383.638450668555
    NODE NAME:
    CUT LINE:
      4545.114, 4880.9598
      4656.77, 5017.726
      4597.0498, 5282.2814
      4677.3141, 5479.0077
      4595.476, 5587.6007
      4619.0831, 5774.8841
    SURFACE LINE:
      4630.0998, 4950.2074, 1000
      4642.187, 5118.089, 900
      4623.8046, 5395.5958, 800
      4615.9355, 5526.222, 700
      4637.9689, 5680.4555, 600
      4587.6069, 5743.4079, 500
  END:
END CROSS-SECTIONS:

```

Figure 12 Sample RAS GIS Import File

- g.** Any text editor or word processor can be used to modify the RAS GIS Import File that is created by this command prior to processing it with the HEC-RAS software.
- h.** If the user wishes to utilize a cross-section data table rather than point features, the [Points from Sections] command will need to be executed prior to using this command so as to

generate the point features that can be processed by this command.

## Summary

Those users who work with HEC-RAS will find the [Points to Hec-Ras Sections] command extremely useful in integrating data stored in ArcGIS with HEC-RAS.

As mentioned at the outset of this publication, the implementation of this command was the direct result of a suggestion we received. So that, we encourage our users and those interested in our software to feel free to pass along their suggestions.

After all, if the software does not address the application being worked on, then there's no need for the software. As such, The CEDRA Corporation tries its best to deliver application solution products.

The implementation of the [Points to Hec-Ras Sections] command is a recent enhancement to the CEDRA-AVland-CrossSection toolbar. Users with a software support agreement should check with The CEDRA Corporation on how to obtain a software update so as to be able to utilize this new functionality.

As always, users who have a need for functionality that is not presently available in CEDRA software should feel free to forward these requests to CEDRA, as well as, any other comments or suggestions you may have.

*If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.*